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ABSTRACT

Contained within this Health Activities Project (HAP) learning packet are activities for children in grades 5-8. Design of the activities centers around the idea that students can control their own health and safety. Within this module are teacher and student folios describing four activities which involve students in learning how to measure their breathing rates and then investigating the effects of breathing style, breath holding, and exercise on breath rate; how to monitor the recovery of their breath rates after exercise; how to measure and practice improving their breath control; and how to measure their maximum lung volumes and investigate the relationship between lung volume and height. (CS)

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HAP HEALTH ACTIVITIES PROJECT

BREATHING FITNESS MODULE

U.S. DEPARTMENT OF HEALTH,
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Folios Included in This Module

WHAT'S HAPpening? This is a teacher's information folio describing the contents and use of the program.

Exploring Breath Rates. After learning how to measure their breathing rates, the students investigate the effects of breathing style, breath holding, and exercise on breath rate.

Breath Recovery. The students monitor the recovery of their breath rates after sprinting and after jogging and compare the results.

Breath Control. The students measure and practice improving their breath control.

Measuring Lung Volume. The students measure their maximum lung volumes and investigate the relationship between lung volume and height.

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WHAT'S HAPpening?

TEACHER'S
INFORMATION
FOLIO

WHAT IS HAP?

The Health Activities Project (HAP) primarily involves fifth- to eighth-grade students with their own health and safety through hands-on, discovery-approach activities. By investigating their own bodies, the students learn firsthand how their bodies function and what they can do. Most importantly, the students discover that *they* can make changes in the way their bodies perform. HAP's main purpose is to make students more aware of the control they have over their own health and safety.

Is there any order to the HAP activities?

The activities fall under four categories or areas of emphasis. We call these categories **modules**. HAP activities may be used independently, but work best when used in sequence within the module framework. Activities that *must* be conducted in a certain sequence contain the appropriate directions in their "Setting Up" sections.

SIGHT AND SOUND Module

Mask Relay. The students play bounce-ball relay with and without vision-restricting masks and compare the results.

Field of Vision. Each student measures his total field of vision and compares it to the area in which he can see clearly enough to read.

Animal Masks. By wearing vision-modifying masks that simulate the fields of vision of different animals, the students discover how different fields of vision necessitate different kinds of behavior.

Pinhole Viewer. The students find out how the amount of light and type of lens affect images produced by a pinhole viewer.

Look, Listen, and Find. By playing two games in which they must rely on nonverbal communication, the students compare the usefulness of sight signals and sound signals.

Where Are You? The students test their ability to pinpoint the location of sound sources and discover one advantage of having two ears.

ACTION/REACTION Module

Reaction Time. The students time and compare their own reactions to light, sound, and touch stimuli.



Improving Reaction Time. The students explore the effect of a training program on their reaction times when they respond to a light stimulus. This activity introduces the students to systematic collection and analysis of data.

Let's Manipulate. By dropping pieces into matching holes, the students practice their eye / hand coordination and discover that practice can improve their performance.



HEART FITNESS AND ACTION Module

Exploring Heartbeats. The students use stethoscopes to locate their hearts and to listen to their heartbeats. They discover how various body positions affect the heartbeat rate.

Exploring Pulse. Each student locates her pulse points, measures her pulse, and compares her pulse rate to her heartbeat rate.

Pulse Recovery. After exercising, the students monitor the recovery of their pulse rates from the increased rate during exercise to their resting rates.

Shape Up. By monitoring their pulse recovery during a period of physical conditioning, the students discover that training can improve physical condition and pulse recovery time.

Grip Strength. After determining the strength of their grips, the students train for one week to improve their grip strength.

BREATHING FITNESS Module

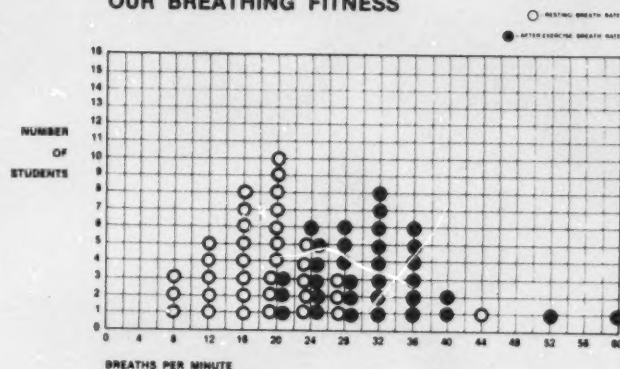
Exploring Breath Rates. After learning how to measure their breathing rates, the students investigate the effects of breathing style, breath holding, and exercise on breath rate.

Breath Recovery. The students monitor the recovery of their breath rates after sprinting and after jogging and compare the results.

Breath Control. The students measure and practice improving their breath control.

Measuring Lung Volume. The students measure their maximum lung volumes and investigate the relationship between lung volume and height.

OUR BREATHING FITNESS



How do you lead a HAP activity? Your role as a HAP teacher is that of a facilitator (one who sets the stage) of learning rather than that of a purveyor of facts. Through many classroom trials we have found that, in many situations, discovery through student activity is more successful than spoon-fed knowledge. The procedure that we recommend you follow is to quickly introduce the activity, demonstrate any special procedures and equipment, and present the students with the challenge or task. Most of the allotted time should be reserved for *student* exploration. Each activity is designed to let your students learn through their own explorations. Follow the activity with questions and discussions that reinforce the students' experience with the ideas and concepts introduced in the activity.

What do you do while the students participate in the activity? While your students work, you have the opportunity to move about the room and spend your time with individuals or small groups. You can participate, lend assistance when it is needed, help students record results, or ask questions that stimulate further activity.

Be flexible. Sometimes your students may become involved in explorations or ask questions that do not lead in the direction you have planned. When this happens, be flexible. These situations can serve as interesting points of departure and often spur further exploration and learning on the part of the students.

How do you lead the discussions? The discussion at the end of the activity is an opportunity for the students to compare discoveries, review the class results, voice their opinions, and share their experiences. Avoid monopolizing the discussion; act rather as a catalyst for discussion.

THE FOLIOS

Thoroughly acquaint yourself with the contents of the activity folio before attempting to lead the activity. Each folio is laid out in a similar format so that you can quickly locate the information you need in each activity.

OVERVIEW

The Overview provides you with a capsule description of the activity.

HEALTH BACKGROUND

This section not only provides you with background information on specific health concepts, but also outlines the activity's general health significance. *Do not read this section to the students!*

MATERIALS

All materials for each activity are listed here. Materials to be provided by the teacher are marked with an asterisk. Such materials include easily obtainable equipment and duplicated Student Sheets. All other equipment is provided in the kit.



SETTING UP

This section outlines the activity's time and advance-preparation requirements. Whenever possible, have your students assist you with the preparation.

THE ACTIVITY

Suggestions on introducing the activity, demonstrating any procedures and equipment, and carrying out the activity are found in this section.



This logo indicates parts of the activity in which the students are actively involved in their explorations.

Analyzing the Data

The questions in this section are designed to help students compare discoveries and results and to interpret the results of the activity.

HEALTH APPLICATIONS

This section contains situational questions that are designed to "bring home" the health or safety significance of the activity. HAP recommends that you wait a day or two after finishing the activity before initiating these discussions.

HAP SIDETRIPS

These additional challenges may be used to extend the scope of the activity for the whole group or for interested students.



This symbol keys you to "Take-Home Ideas": activity-related exercises that the students can take home.



In some cases, the last HAP Sidetrip suggests an activity in which parents and children can participate during an "Open House" night at school.

THE INSERTS

Equipment Cards, Technique Cards, and duplicator masters of the Student Sheets for this module are contained in the module packet. You may wish to insert these sheets into the appropriate folios. The duplicator masters are provided for your use in making photocopies or

your own spirit masters. Do not write on the masters. Use them only for your reference and for the copies you make for the students.

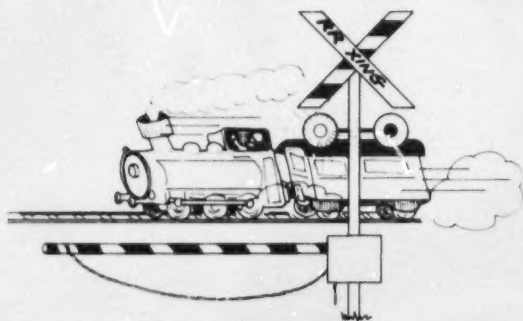
HINTS

Over the years we have discovered some general approaches that improve the flow of learning in the experiential science approach employed by HAP. You probably know and use some of these techniques already, but for those of you who are unfamiliar with the experiential approach, we mention some techniques here.

1. **Equipment.** Make sure that all of the required equipment is present. Do not assume that equipment is in the box.
2. **Preparation.** Check the "Setting Up" section of the folio to find out what you have to do *before* the activity. For instance, in *Reaction Time* the batteries must be installed and the timers checked before you conduct the activity.

- **Charts.** Before posting HAP charts for your class, make sure that all data (adhesive dots, crayon markings) from previous classes have been removed.

3. **Distributing the Materials.** Do not distribute the materials until you have finished the introduction and any demonstrations, and the students have been primed with a challenge and are ready to begin. If distributed earlier, equipment often diverts the students' attention from any instructions you may still have to give.



4. **Interaction.** Hands-on, discovery-approach activities generate a great deal of student-to-student verbal interaction. While participating in HAP activities, children often spontaneously exchange observations and ideas, so be prepared for higher than normal noise levels. This activity-oriented peer interaction is a valuable part of the learning process in HAP activities, so don't discourage it. You should, of course, keep the noise level reasonable (i.e., the children don't have to shout).

WE WANT TO HEAR FROM YOU



These HAP activities have been through both local and national trials with over 2,000 children in regular classrooms. Even so, we know that you will have contributions to make to the Publisher, and we encourage you to do so. Any suggestions on format, equipment, and procedures are extremely important to future revisions. Please submit your ideas to: Dr. Roy Gromme, HAP Project Coordinator, Hubbard, P.O. Box 104, Northbrook, Illinois 60062.

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EXPLORING BREATH RATES

BREATHING FITNESS Module



OVERVIEW

The students learn how to measure their breathing rates and discover how breathing styles, breath holding, and exercise affect the breathing rate.

HEALTH BACKGROUND

Along with blood pressure, temperature, and pulse, the breathing rate is one of the four *vital signs* that health professionals use to assess the condition of a sick or injured person. Most people are conscious of their breathing only when they have difficulty with it. Running hard

or climbing a hill increases the breathing rate because the level of carbon dioxide (waste gas) in the body is increased. The concentration of carbon dioxide in the body determines the breathing rate.

Most breathing is *involuntary*, the rate being determined by the body's level of activity. Breathing can, however, also be controlled *voluntarily*. Almost everyone has had to take long, deep breaths for the doctor or hold her breath while under water. Voluntary breath control depends on one's ability to control the muscles involved in breathing. These muscles include the diaphragm and the intercostals (muscles between the ribs).

Although an individual can hold her breath, she is merely postponing her body's exchange of air. During the short time she can voluntarily stop her breathing, her body continues to use oxygen and produce carbon dioxide. The increasing carbon-dioxide level automatically triggers breathing at a faster rate until the waste levels return to normal.

Heavy smokers and individuals with respiratory diseases such as emphysema often experience breathing difficulties during strenuous activity. With their lowered breathing efficiency, these individuals do not have a sufficient respiratory capacity for doing strenuous physical work.

MATERIALS

For each student:

1 sheet of scratch paper*

For the class:

1 HAP clock

1 C-cell battery

1 "Our Breathing Fitness" chart

30 green dots

30 orange dots

*Provided by the teacher.

SETTING UP

Suggested Time:

- Plan for a total of 50 minutes for Parts One through Four.
- You may want to break the activity between Parts Three and Four.

Preparing for the Activity. Attach the chart to the chalkboard. Place a green dot for the resting rate and an orange dot for the after-exercise rate on the chart key.

THE ACTIVITY: PART ONE

Introducing the Activity

1. Tell the students that they will explore their breathing rates today.
2. Explain that they will find out what their normal breathing rates are and how various activities affect these rates.

3. Ask the students to breathe differently than they normally do. (The students should all be seated.)

- Allow time for experimentation.
- Select several students who have discovered unusual breathing styles to demonstrate and lead the class in these styles of breathing.
- If the students don't come up with short rapid breathing and deep slow breathing, introduce these two methods.

4. After the demonstration, ask questions such as:

- Were you breathing *automatically* (involuntary breathing) or were you *controlling* your breathing (voluntary breathing)?
- When do you breathe automatically?
- When do you control your breathing?



Finding the Resting Rate

1. Tell the students that they will count the number of *complete* breaths they take per minute.

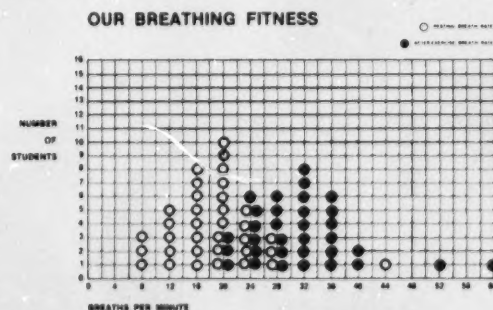
- Explain that the easiest way to do this is to count each *exhalation* (breathing out) as one breath.

2. Ask the students to take one-minute counts of their breaths three times, recording each count on a piece of scratch paper. (One-minute breathing rates at this age are generally between 10 and 25.)

- Students who count more than 35 breaths may be counting both inhalations *and* exhalations, counting inaccurately, or may have excessively high breathing rates.
- Find out what the problem is and help them.

Graphing the Data

1. As soon as each student completes her three resting-rate trials, she should record her middle value on the chart.



2. Explain the graphing procedure:

- The first student with 12 breaths per minute places a green dot at the intersection of the 12-breaths-per-minute line (vertical) and the 1-student line (horizontal).
- A second student with 12 breaths per minute would place his dot on the same vertical line but at the next higher intersection (2-students line), indicating that there are now two students who take 12 breaths in a minute.
- Dots for odd-numbered breathing rates should be placed on the next highest even-numbered line.

THE ACTIVITY: PART TWO

Introducing Part Two

1. Tell the students that they will now find out how holding their breath affects their breathing rates.
2. Instruct the students to:
 - Hold your breath for 30 seconds after the "Ready, hold your breath" signal.
 - At the "Stop and count" signal, count your breaths for one minute.
 - At the "Record" signal, record your results on your piece of scratch paper.



Finding Out How Breath Holding Affects Breathing Rate

1. Give the signal: "Ready, hold your breath."
2. At the end of thirty seconds, say: "Stop and count."
3. Sixty seconds later, say: "Stop and record."

Analyzing the Data. Use the following questions to help the students understand that breath holding results in an increase in breathing rate, which helps the body make up for the lack of breathing for thirty seconds.

1. Was there a difference between your resting rate and your rate after holding your breath?
2. How different were your two rates? Which was higher?
3. Why do you think your rate was higher after holding your breath for thirty seconds?

THE ACTIVITY: PART THREE

(In this part of the activity the students discover the difference between breathing with *only* the diaphragm and breathing with both the diaphragm *and* the intercostal muscles.)



Investigating the Muscles Involved in Breathing.

Ask the students to follow this procedure:

1. Put your hands on your ribs, and breathe deeply.
 - Describe what happens. (Usual responses are that the ribs move in and out or up and down.)
2. Put one hand on your abdomen just below your ribs.
 - Describe what happens when you breathe deeply and then when you take shallow breaths.
3. Place one hand on your ribs and one hand on your abdomen.
 - Describe what happens when you take deep breaths and when you take shallow breaths.



Analyzing the Results

1. Encourage the students to discuss their results.
 - What happens with deep breathing?
 - What happens with shallow breathing?
2. The discussion will usually indicate that the children understand that deep breaths involve expansion of the chest and that shallow breathing uses the diaphragm only.

THE ACTIVITY: PART FOUR

Introducing Part Four. Ask the students what they think might happen to their breathing rates when they jump in place as high as they can for thirty seconds.



Determining After-Exercise Rates

1. Time the students while they jump rapidly for thirty seconds.
2. Immediately after they finish jumping, have the students count their breaths for one minute.
3. Tell the students to use orange dots to record their after-exercise rates on the chart. (These dots should be placed beside the green dots.) In most classes, the chart will show clearly that exercise increases the breathing rate.

Analyzing the Data

1. Ask the students:
 - How did your results compare with what you thought would happen?
 - Looking at the histogram, what is the *range* of after-exercise breathing rates (the difference or area between the highest and lowest rates, e.g. 16 to 35)?
 - What could have contributed to the variation? (How fast they jumped, different levels of fitness.)
2. Discuss with the students how other activities might affect their breathing rates (sprinting, long-distance running, sitting, sleeping).

HEALTH APPLICATIONS

1. You get the "wind" knocked out of you during a football game. What will happen to your breathing rate after you can breathe again?
2. You have just started running every night. Your ribs usually hurt after you have run a quarter of a mile.
 - Why do you suppose they stop hurting after you walk for a while?

HAP SIDETRIPS

1. Try some other activities that you think will raise your breath rate. Do they all require exercise?
2. Breathe for one minute using only your diaphragm. How do you feel? Could you breathe for an hour like that? Breathe for another minute just using your ribs. Which type of breathing feels better? Why?
3. Pretend that you are going to blow out 100 candles on a birthday cake. How do your head and chest move? Why do you think this happens?



Take-Home Idea. Help the members of your family measure their breathing rates. Who has the fastest rate? Who has the slowest rate?



BREATH RECOVERY

BREATHING FITNESS Module



OVERVIEW

The students monitor their breath recovery after sprinting and after jogging and compare the two recovery times.

HEALTH BACKGROUND

The body's cells need oxygen in order to produce energy. The chemical processes that produce energy also produce carbon dioxide, a waste product that must be continuously removed from the body. During exercise, the concentration of carbon dioxide in the blood increases, causing a comparable increase in the breathing rate. After exercise, heavy breathing continues until the carbon dioxide level returns to normal.

A rapid recovery of the breathing rate after exercise indicates an ability to rapidly remove carbon dioxide. This may be due to efficient breathing, greater lung volume, a more efficient circulatory system, or more effective gas exchange in the body. A short breath recovery time is usually a sign of physical fitness.

MATERIALS

For each student:

- 1 copy of each Student Sheet: BR 1* and BR 2*

For the class:

- 1 HAP clock
- 1 C-cell battery
- duplicator masters of Student Sheets BR 1 and BR 2

* Provided by the teacher.

SETTING UP

Suggested Time: Conduct this activity after the students have completed *Exploring Breath Rates*.

- Plan for 40 minutes for Part One.
- Plan for 40 minutes for Part Two.

Preparing for the Activity

1. Find two objects that are about 50 meters apart to serve as markers between which the students can run. Basketball support posts on playgrounds are ideal.
 - An outdoor site is best for this activity, but you can conduct it inside. If you conduct the activity indoors, substitute jogging in place for jogging and fast jumping jacks for sprinting.
2. Insert the C-cell battery into the HAP clock.
3. Duplicate the Student Sheets.

THE ACTIVITY: PART ONE

Introducing the Activity. Tell the students that they are going to raise their breath rates first by sprinting and then by jogging. After each exercise session they will find out how long their breath rates take to return to normal.



Establishing the Resting Breath Rate

1. Make sure that all the students are seated.
2. Explain to the students:
 - Before you monitor your breath recovery, you must first determine your resting rate.
 - The best way to determine your resting rate is to count your exhalations for one minute.

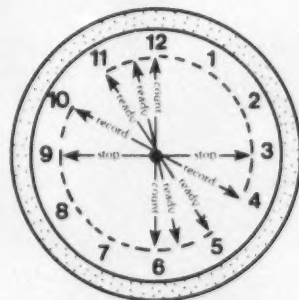
3. Give each student a pencil and a copy of Student Sheet 1.

4. Conduct a one-minute counting session for students.

- Tell them to record their resting rates on their Student Sheets under "Part One."

Introducing the Counting and Recording Procedure

1. Ask the students to read "Part Two" of their Student Sheets.
2. Explain to the students that you will conduct fourteen 15-second counting sessions after each exercise.
3. Have the students practice the procedure by recording five or six 15-second counts on the back of their Student Sheets.
 - With everyone sitting, say "Ready," pause, "Ready," pause, "Count." Time your words so that when you say "Count," the clock's second hand is at zero seconds to make this easier.
 - At exactly 15 seconds, say "Stop and record" and keep your eyes on the clock.
 - Ten seconds later, start your "Ready, Record, Count" routine; the word "Count" then coincides with the second hand's arrival at the 30-second mark.
 - A sample scheme for a one-minute period is illustrated.



Preparing for the Sprint

1. Take the clock and the students out to the running area.
2. Make sure that everyone is ready.
 - Each student should have a copy of Student Sheet 1 (folded into quarters for easy carrying and recording) and a pencil.

Name _____

MONITORING YOUR BREATH RECOVERY

PART ONE: RESTING BREATH RATE

My resting breath rate is

_____ breaths per minute.

PART TWO: AFTER-EXERCISE BREATH RATE

1. Sprint or jog.
2. Stop.
3. Sit and get ready for your teacher to say: "Ready, Ready, Count."
4. At the "Count" signal, count your breaths (exhalations only) for 15 seconds.
5. When your teacher says "Stop and record," record that count in the box next to 0.0.
6. Listen for your teacher to say "Count" again.
7. Repeat the counting and recording procedure.
8. Keep doing this for 6.5 minutes, even if your breath rate returns to normal.
9. If you miss a count, skip that box and wait for your teacher's next "Count" signal.



AFTER SPRINTING		
MINUTES AFTER EXERCISE	BREATHS IN 15 SECONDS	BREATHS PER MINUTE
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		

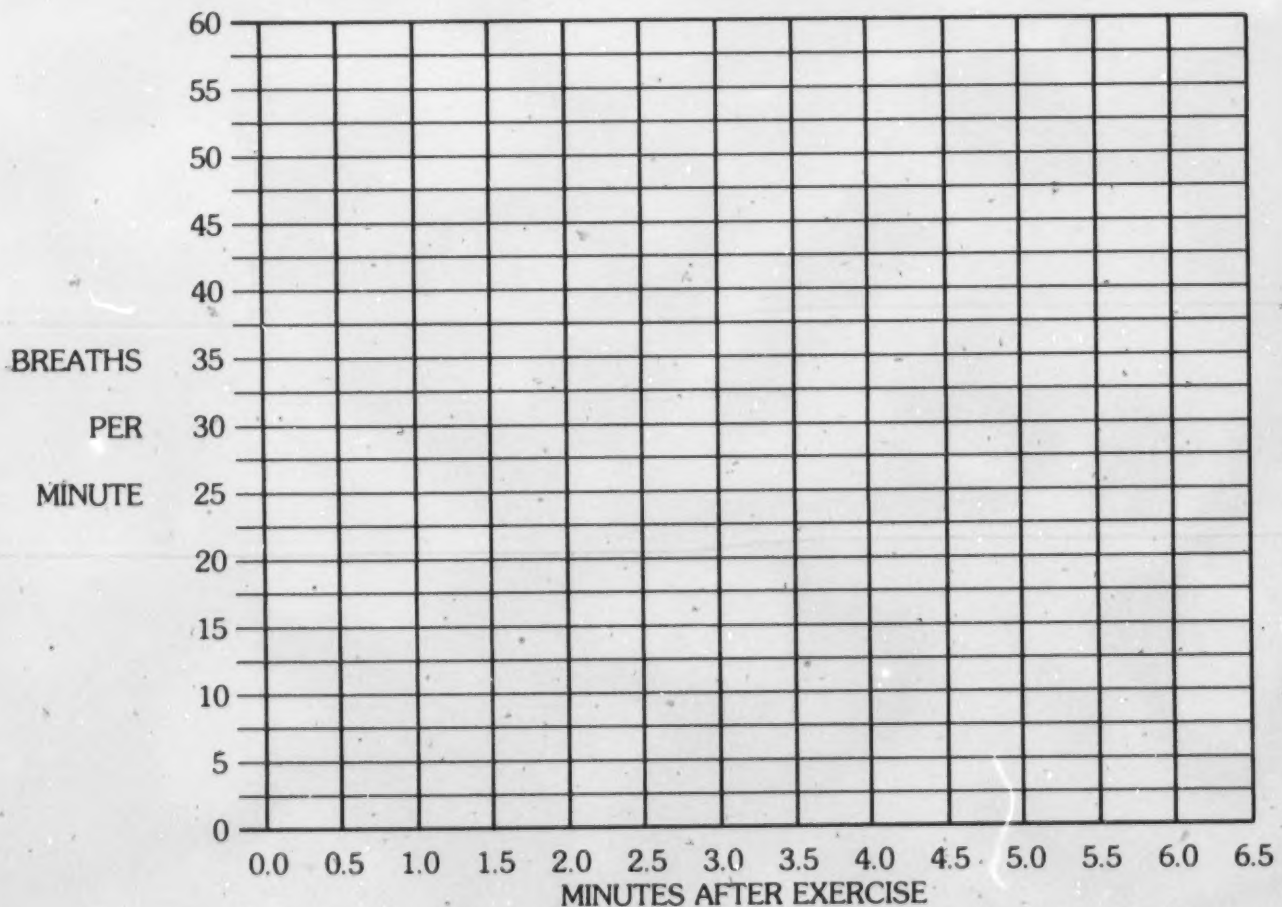
AFTER JOGGING		
MINUTES AFTER EXERCISE	BREATHS IN 15 SECONDS	BREATHS PER MINUTE
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		



Name _____

GRAPHING YOUR BREATH RECOVERY

1. Draw a horizontal line across the chart at your resting rate. Label this line "Resting Breath Rate."
2. Plot your after-sprinting data with X's and connect the X's with a solid line. Label this line "After Sprinting."
3. Plot your after-jogging data with dots and connect the dots with a dashed line. Label this line "After Jogging."



4. When was your breath rate highest? Circle one: AFTER SPRINTING or AFTER JOGGING
5. What was your after-sprinting breath recovery time? _____ minutes
6. What was your after-jogging breath recovery time? _____ minutes

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HEALTH ACTIVITIES PROJECT



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- Line the students up side by side next to one marker and facing the other marker.
- Have the students set their pencils down.
- Make sure that you can see the clock.

3. Explain the sprint and breath-recovery monitoring procedure.

- You will run as fast as you can to an imaginary line at the other marker and back to the starting line (a total of 100 meters) and then immediately sit down.
- The counting will start immediately.
- Get settled quickly—there will be no waiting for stragglers.
- If you miss a count, skip that one and get ready for the next count.
- Continue counting your breaths for the full 6.5 minutes, even if your breathing returns to normal.
- Concentrate on *counting*, not on breathing.



Sprinting and Monitoring

1. Give the students the "GO" signal.
2. As soon as most of the students are seated, start the counting procedure.
 - Don't wait for stragglers.
 - Count for the full 6.5 minutes.

Preparing for the Jog

1. With the students still sitting, have them check their breath rates.
 - Don't start the jog until everyone's breath rate has returned to the resting rate.
2. Tell the students that now they will monitor their breath recovery after jogging.
3. Select a pacer to lead the jog. Explain to the students:
 - No one will jog faster than the pacer, and everyone must stay together.
 - The pacer will lead you in a 200-meter jog (back and forth twice between the markers).
 - The rest of the procedure will be the same.



Jogging and Monitoring

1. Make sure that all the students have their Student Sheets and know where to record their counts.
2. Have the pacer lead the jog.
3. Immediately after the students have jogged the 200 meters, have the students sit down.

4. Start the counting procedure

5. After you have completed the monitoring procedure, take the students back to the classroom.

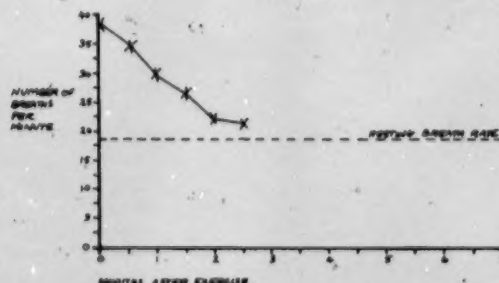
THE ACTIVITY: PART TWO

Plotting the Resting Rate

1. Have the students convert each of their 15-second counts to one-minute rates by multiplying each count by 4.
2. On the chalkboard, draw a blank graph similar to the one illustrated (and on Student Sheet 2).
3. Give each student a copy of Student Sheet 2.
4. Ask one student to show you where his resting rate would be on the chalkboard graph.
 - Draw a dashed horizontal line from this point to the right edge of the graph and label the line "Resting Breath Rate."
5. Ask the other students to plot and label their resting breath rates on their copies of Student Sheet 2.

Plotting the After-Sprinting and After-Jogging Recovery Rates

1. Ask another student to give you the one-minute breath rate she recorded in the 0.0 minutes-after-exercise column in her "After Sprinting" chart.
2. Review with the students how to plot points.
 - Find the time in minutes on the horizontal line (0.0) and then move up along the vertical line to the student's number of breaths per minute.
 - Mark that point with an X.



3. Repeat the procedure for several more of the students' rates, then draw a solid line through the X's. Label this line "After Sprinting."

4. When you are certain that the students understand how to plot their after-sprinting data, tell them how to plot their after-jogging data.

- Use dots instead of X's.
- Connect the dots with a dashed line.
- Label this line "After Jogging."
- Your finished graph should have three distinct lines (resting, after-sprinting and after-jogging).

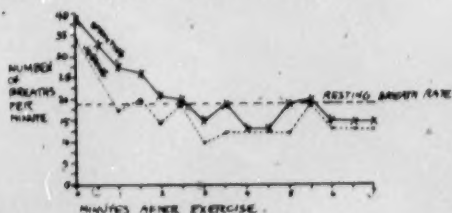
5. Have the students plot their data.

- Walk among the students, helping any who might be having trouble plotting.
- Observe the number of graphs that show the solid line above the dotted line.

6. Erase the beginning of the sprinting line you started on the chalkboard graph.

Determining Recovery Times

1. On the basis of your observations of the students' graphs, draw an average recovery curve for sprinting and one for jogging on your chalkboard graph. (You may copy the lines in the illustration if you wish.)



2. Working from this graph, ask the students which breath rate was the highest immediately after exercising.

- Ask each student to find his or her own highest breathing rate and to answer question 4 on Student Sheet 2.

3. Show the students how to find out when their breath rates returned to normal.

- Follow the recovery curve with a pointer from the 0.0 vertical line to the point where it first

crosses the resting breath rate line.

- Draw a vertical line from this point to the bottom of the graph to find your recovery time.

4. Ask the students to answer questions 5 and 6 on Student Sheet 2.

Analyzing the Data

1. How did your after-exercise breath rates compare with your resting rate?

2. Did you breathe faster while you were sprinting or while you were jogging? Why might that be?

3. Are the results what you expected? Explain.

4. How could it be possible for you to take more steps while jogging than while sprinting and yet breathe faster after sprinting?

HEALTH APPLICATIONS

1. In what other exercises do you breathe fast? How do you think your recovery rate after those exercises would compare to your after-jogging and after-sprinting recovery times?

2. What effect do you think sprinting three times a day for a month would have on your recovery time?

HAP SIDETRIPS

1. Lead both older and younger students in this activity, and compare their breath recovery times.

2. Your students can take this Sidetrip if they have completed the *Pulse Recovery* activity in the "Heart Fitness and Action" module.) Compare your breath recovery time with your pulse recovery time. Have a partner count your breaths while you take your pulse.



Take-Home Idea. Lead your family in a sprint. Which members of your family have the fastest breath recovery? How fast does your dog's breath rate recover?



BREATH CONTROL

BREATHING FITNESS Module

OVERVIEW

The students find out how well they can control their breathing and then practice to improve their control.

HEALTH BACKGROUND

The body's cells constantly need oxygen in order to produce energy. The chemical processes that produce energy also produce carbon dioxide, a waste product that must be continuously removed from the body. Since oxygen cannot be stored in the body for any length of time, and because carbon dioxide would kill us if not removed continuously, the body must constantly exchange air. The amount of time that we could survive without exchanging air is minimal.



The automatic nature of breathing is crucial to this continuous exchange. For example, if the response were not automatic, how could we breathe while we slept? The level of concentration of carbon dioxide in the body determines how often and how deeply we breathe. We can control our breathing to some extent, but only up to the point where we would damage ourselves by not exchanging oxygen and carbon dioxide. At that point, the body's automatic control mechanism automatically forces us to breathe.

Our ability to modify our breathing allows us to talk, eat, whistle, sing, swim, remain absolutely silent, blow glass, and play musical wind instruments.

By increasing the control over the force and duration of their exhalations, the students can also improve their language, speech, singing, and athletic skills, as well as their ability to play certain musical instruments.

MATERIALS

For each team of three:

- 1 breath-control device (scale, base, and air-guide tube)
- 3 copies of Student Sheet BC*

For the class:

- 1 HAP clock
- duplicator master of Student Sheet BC

*Provided by the teacher.

SETTING UP

Suggested Time:

- Plan for 40 minutes for Part One.
- Plan for 10 to 15 minutes on each of several days for Part Two.
- Plan for 30 minutes for Part Three.

Preparing for the Activity

1. Assemble the breath-control devices.
 - Roll the air guide into a tube (dull side out), and fit the flaps into the slots.
 - Insert the air-guide tube into the large opening on the face of the scale so that the

cutout slits catch on the sides of the opening.

- Insert the scale and tube into the base.
2. Insert the C cell battery into the HAP clock. Position the clock so that it will be visible to all of the students.
 3. Music and speech teachers may also find this activity valuable for their students. You may wish to invite these teachers to watch this activity.
 4. Duplicate the Student Sheet.

THE ACTIVITY: PART ONE

Introducing the Activity

1. Ask the students to hold their breath for 20 seconds.
2. If anyone breathed before 20 seconds elapsed, ask them:
 - Why did you breathe?
 - Did you want to breathe or did you have to?
3. Now ask the students about their ability to control their breathing.
 - Can you control your breathing?
 - Are there limits to your control?
 - What kinds of things do you do that require you to control your breathing?
 - Did you control your breathing at any time today? What were you doing?
4. Show the students a breath-control device, and tell them that they can use it to find out the extent of their own breath control and whether they can increase their control.

Demonstrating the Procedure

1. Carry the device as you walk among the students demonstrating the use of the device.
 - Put your chin against the extended tip of the tube and blow hard enough to raise the cylinder in the tube.



SUBJECT's Name _____

Breath Control
Student Sheet BC

TESTING YOUR BREATH CONTROL

TIME IN SECONDS

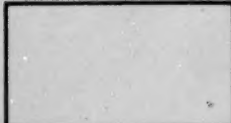
TRIAL NUMBER	BEFORE TRAINING				AFTER TRAINING			
	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 1	ZONE 2	ZONE 3	ZONE 4
1								
2								
TOTAL								
Divide by 2	+ 2	+ 2	+ 2	+ 2	+ 2	+ 2	+ 2	+ 2
AVERAGE TIME IN SECONDS								

- Graphing your data:
 - Plot on the graph your average time for each zone.
 - Use a dotted line to connect your "Before Training" times and a solid line for your "After Training" times.
- Did you improve with practice?

3. Finding your percent improvement in breath control for zone 4:

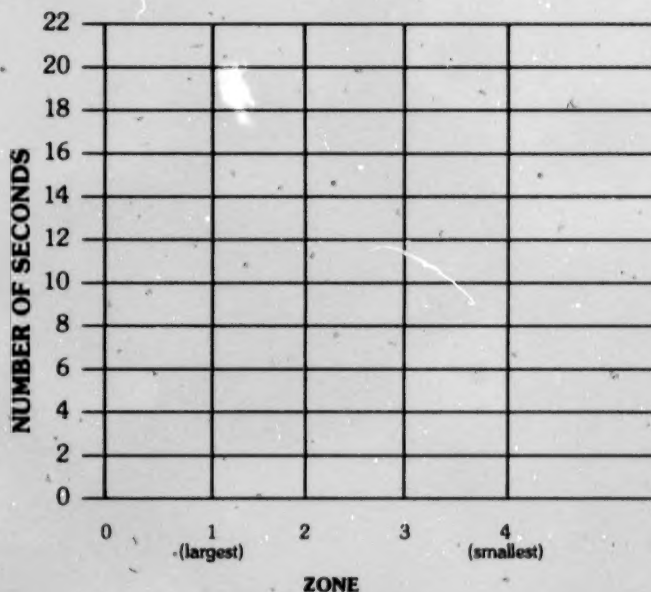
a.  -  = 

b.  $\times 100 =$ 

c.  $\div$  = 

% IMPROVEMENT

IMPROVEMENT GRAPH



19

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HEALTH ACTIVITIES PROJECT



- Walk close to the youngsters so they can see the cylinder moving up and down in the tube. (Keep the device vertical.)
2. Point out the four zones on the scale, and explain that:
 - Each student will try to keep the cylinder within each zone for as many seconds as possible.
 - Each student will test his control in the easy large zone and then in the successively smaller zones.



Practicing the Timing

1. To measure the time the cylinder stays in each zone, everyone will have to learn to count seconds. Watching the clock and the cylinder at the same time is too difficult.
2. To help the students count seconds, follow this procedure:
 - Count out loud using the HAP clock as a reference: "One thousand and one, one thousand and two . . ." for several five-second periods.
 - Have the students count out loud with you for several more five-second periods.
 - Have the students count silently while you time them for periods of two, five, and eight seconds. Say "Ready . . . ready . . . count," watch the clock, and say "Stop" after the appropriate number of seconds. Check to make sure that their counts are correct.
 - Discuss discrepancies in results, and have the students practice as necessary.

Organizing the Class

1. Divide the class into teams of three.
2. Explain the roles of the three team members and the procedure:
 - The SUBJECT has her breath control measured.

- The TIMER counts the seconds the entire cylinder stays within a zone.
- The RECORDER records the number of seconds on the SUBJECT's Student Sheet.
- Each student takes two trials for each zone on the device.
- The activity works best if all the team members measure their control in the large zone before anyone tests his control in the other zones



Measuring Breath Control

1. Give each student a Student Sheet and each team a breath-control device.
2. Give the class about five minutes of practice time before you start the trials.
3. Start the trials.
 - Have the students record their results in the "Before Training" part of the table on their Student Sheets.
4. Collect the equipment before holding the discussion.

Analyzing the Results. Ask the students:

1. How easy was it to control the cylinder?
2. How hard did you have to blow to keep the cylinder in each zone?
3. How long could you keep the cylinder in each zone?
4. Did you notice any improvement between the trials?

Setting up the Training Program

1. Tell the students that they are going to find out if by practicing they can increase their breath control.
2. Explain that you will provide classroom time for the next few days for them to practice their breath control.
 - Have the students decide how many days they should practice.
 - Each day they will practice keeping the cylinder in each of the four zones.
3. Collect the Student Sheets, and save them for Part Three.

THE ACTIVITY: PART TWO



Training to Increase Breath Control

1. For the next few days, have the students conduct two trials for each of the zones each day.

- Either set aside a time when the whole class can run trials at once, or let the teams conduct trials throughout the day.

2. Leave the breath-control devices out for the students to use.

THE ACTIVITY: PART THREE



Measuring Improvement

1. After the students have practiced for the agreed-upon number of days, have everyone measure his breath control a second time.

- Return the Student Sheets to the students.
- The students should record their results in the "After Training" part of the table on their Student Sheets.

2. Show the students how to graph their "Before Training" and "After Training" breath control times on their Student Sheets.

- Ask the students to label the lines.
- Then have the students answer the question on improvement and figure their percent improvement on their Student Sheets.

Analyzing the Results

1. Ask the students to share their percent improvement scores. (By concentrating on the percent improvement instead of the final score, low scoring students have an excellent opportunity to succeed.)

- You may want to average the students' scores to find an overall class improvement score.
- If any students did not train, compare their percent scores with the scores of those who trained.

2. Mention to the class that many people feel better about themselves when they develop or improve any of their abilities.

- Invite students to tell of their own experiences with this or any other skills they have developed.

HEALTH APPLICATIONS

1. Your friend has a good singing voice but can't seem to hold his breath as long as others in the choir. Should he quit the choir? What else could he do?

2. What are some possible benefits from improving breath control? (Swimming, singing, free diving, playing instruments, not choking on food, whistling, being a good disc jockey or speaker.)

3. You have to cough, but you are in a social situation where you would attract too much attention if you did. How could breath control help you?

4. How could a runner use good breath control?

HAP SIDETRIPS

1. Test the breath control of younger and older people. Who has better control?

2. Test the breath control of smokers.

3. Measure your breath control while you slump over a desk, sit straight up, and stand. Show your results to your school's choir director or drama coach.

4. What happens to your breath control after exercising? Does exercising affect force or duration?



Take-Home Idea. Find out how long each of your family members can hold a note, whistle, or blow a musical instrument with one breath.



MEASURING LUNG VOLUME

BREATHING FITNESS Module

OVERVIEW

The students measure their maximum lung volumes and investigate the relationship between lung volume and height.

HEALTH BACKGROUND

Lung volume is a simple term for *vital capacity*, which is the volume of air a person can expel after taking his deepest possible breath. This volume is not really the *total* lung volume, because some air always remains in the lungs.

Lung volumes vary greatly among individuals. Factors such as sex, age, height, weight, inherited traits, and exercise patterns contribute to a person's maximum lung capacity. In this activity, the youngsters discover how lung volume relates to height.

Your students' lung volumes will probably vary greatly, even taking height into consideration. Other factors such as the effort used to blow into the bag, accuracy of measurement, and sex will affect their results. Most will have volumes between 1.5 and 5 liters. Although one might think that smokers would have lower volumes than nonsmokers, any such reduction is probably due to factors other than smoking. Smoking does not lower lung volume unless it contributes to a disease such as emphysema, which stiffens the lung tissue. Smoking does, however, affect normal breathing volume (*tidal volume*) by decreasing the efficiency of the lung tissue in exchanging oxygen and carbon dioxide.

Any reduction of a person's lung volume may indicate a medical problem. Emphysema, fibrosis of the lungs, and asthma all reduce lung volume. Regular exercise requiring heavy breathing is one way of increasing lung volume.



MATERIALS

For each team of two:

- 1 lung-volume bag
- 2 plastic mouthpieces
- 1 mouthpiece holder
- 1 rubber band
- 2 copies of Student Sheet MLV*

For the class:

- 1 Disinfectant Kit
- 1 "Our Lung Volumes" chart
- 60 red dots
- 1 eraseable crayon
- 4 metric tapes
- 4 books*
- tacks* or masking tape*
- 1 "Disinfecting the Equipment" Technique Card
- duplicator master of Student Sheet MLV

*Provided by the teacher.

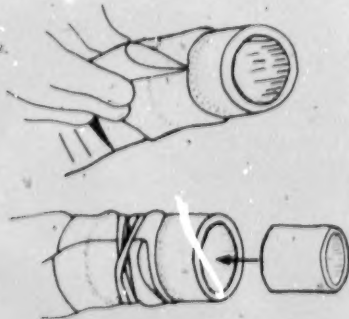
SETTING UP

Suggested Time:

- Plan for 40 minutes for Part One.
- Plan for 20 minutes for Part Two.

Preparing for the Activity

1. Set up one Soaking Station according to the directions on the "Disinfecting the Equipment" Technique Card.
 - If you are unsure of the cleanliness of the mouthpieces, disinfect them.
2. Select a few students to use the rubber bands to attach 14 lung-volume bags to the mouthpiece holders. (The holders have larger diameters than the mouthpieces.) Neat folds around the holder will insure the airtightness of the bags.



LOOP THE RUBBER BAND THREE TIMES.

3. Tape the chart to the wall.

- Fold up the bottom of the chart so that the resulting flap just covers the horizontal axis of the chart. (The height information should not be visible to the students.)
- Lightly tape the folded edge in place.
- Set the red dots near the chart.

4. Duplicate the Student Sheet.

5. For Part Two. Select four flat-wall surfaces for height-measuring stations.

- At each station, tape a metric tape to the wall so that the zero mark is level with the floor.

THE ACTIVITY: PART ONE

Introducing the Activity

1. Ask the students if they know how much air their lungs can hold.
2. Tell them that they will measure their lung volumes by blowing into bags marked off in liters. (A liter is about one quart.)
3. Ask each student to predict how many liters of air he can blow into a bag when he takes his deepest possible breath and blows it all into the bag.
4. Distribute the Student Sheets, and have the students record their predictions.

Demonstrating the Use of the Lung-Volume Bags

1. Select one student to be the SUBJECT, while you assume the role of MEASURER.
2. Insert a mouthpiece into a mouthpiece holder attached to a bag.
3. Make sure the bag is empty of air by flattening it against your thigh.
4. Ask the SUBJECT to take his deepest possible breath and to blow all of it into the bag.
 - As soon as the SUBJECT has finished expelling air, grasp the bag just below the holder, and twist it to trap the air.
 - Wrap the bag tightly around your hand until the bag becomes stiff.
5. Ask the SUBJECT to read the volume from the scale on the bag and to record this value on the chalkboard.

Name _____

MEASURING YOUR LUNG VOLUME

1. Predicting. I predict that I can blow _____ liters of air with one breath into the bag.

2. Practicing

- Stand up, and blow all the air you can with one breath into the bag.
- Your partner wraps the bag tightly around her hand until the bag is stiff.
- Read your measurement off the bag.



3. Measuring

- Take three more trials like the practice trial.
- Record your three volumes in the table below.
- Total the three trials.

TRIAL NUMBER	VOLUME		
1	_____ liters		
2	_____ liters		
3	_____ liters		
TOTAL FOR THREE TRIALS	_____ liters	÷ 3	= _____ liters

AVERAGE LUNG VOLUME

4. Divide the total by 3 to find your average lung volume.

5. Why do you think everyone's lung volume is not the same?



- Other students can verify the quantity of air in the bag.

6. Show the students how to empty the bag.



7. Discuss with the students the differences in results that might arise:

- if the bag were not empty at the start.
- if two breaths were blown into the bag.
- if the bag were not wrapped snugly around the hand.

8. Ask the SUBJECT to complete two more trials and to record the volumes on the chalkboard.

- Help the SUBJECT average the three values, and have him circle the average.

9. You can help avert unwanted competition

- not blowing into the bag yourself, even during the demonstration. (If you were to fill it up, you might present a model the students would feel they had to emulate.)
- not giving special attention or approval to students with exceptionally large lung volumes.



Measuring Lung Volume

1. Explain the procedure. Each student:

- takes one practice trial.
- breathes into the bag three times and records his three lung volumes.
- averages his results on his Student Sheet.
- places a red dot on the chart on the vertical dashed line (left side of the chart) next to his average lung volume.

2. Ask the students not to overlap their dots if their volumes are the same. They should place the dots side by side, with edges touching.

3. Divide the class into teams of two.

4. Let the students get their materials and begin.

- Tell the students that they each have their own mouthpieces and should not use anyone else's.
- Assist those having trouble.

Note: The students' average lung volumes will also be used in Part Two.

5. After all the students have completed their trials, collect the equipment.

Analyzing the Data

1. Point out the highest and lowest values on the chart, and explain that the difference, or the area between the two numbers (e.g. 1.5 to 4), is called the **range**.

2. Ask the students:

- Does there seem to be a lot of variation? (Are the dots scattered?)
- Since you are all about the same age, why do you suppose your lung volumes vary so much?

3. Encourage the students to offer as many explanations for the range and variation as they can.

Cleaning the Mouthpieces. If you are not going to conduct Part Two immediately, assign two students to disinfect the mouthpieces.

THE ACTIVITY: PART TWO

Introducing Part Two

1. If the students did not mention height as one explanation for the variation in lung volumes, suggest it.

2. Unfold the bottom of the chart, explaining that the chart is designed for plotting lung volume against height.

3. Tell the students that they can measure their heights and find out how height relates to lung volume.

Demonstrating the Height-Measuring Procedure

1. Ask one student to take off her shoes and stand with her back against one of the metric tapes on the wall.

- Her heels, buttocks, and shoulders should touch the wall, and she should keep her back as straight as possible.
- Her feet should be flat on the floor, with her heels close together.

2. Have her partner place a book on her head, making sure that the edge of the book against the wall is flat against the wall.

- The number where the bottom of the book's binding (the surface lying on the student's head) is the student's height.

3. Give the student whose height was just measured a red dot, and ask her to place it on the chart where the line from her height meets the average for her lung volume.



Relating Lung Volume to Height

1. Let the students begin.

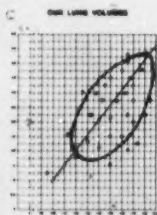
- Each student measures his partner's height and records his own height in the box in the lower right-hand corner of his Student Sheet.

2. Remind the students to place their dots on the chart where their heights and lung volumes meet.

Analyzing the Data

1. After all the students have posted their dots, use an eraseable crayon to enclose most of the dots with an ellipse.

- This procedure excludes some of the extreme data and makes the general trend more apparent.
- You might even draw a heavy line from one end of the ellipse to the other to further define the trend.



2. Ask the students what the chart shows about the relationship between height and lung volume. (Lung volume usually increases with height. If the students are all too close

in height, the trend may not be clear. If this is the case, you might want the students to do the first HAP Sidetrip.)

Cleanup. Ask the students to disinfect the mouthpieces.

HEALTH APPLICATIONS

1. Assuming that you could have a lung-volume bag of your own, how could you use it to monitor your health?

2. Let us say that you are twelve years old now and have a lung volume of 3.8 liters. When you are seventeen, you measure your lung volume again and it is 3.9 liters. Would you worry? Why? If you were worried, what would you do? Use the chart to determine how lung volume changes with height.

HAP SIDETRIPS

1. Measure and graph the lung volumes and heights of taller and shorter students in other classes.

2. Does running change your lung volume? Measure your lung volume before and immediately after running.

3. Does your body position affect your lung volume? Measure your lung volume while you stand, sit with your chin touching your chest, and lie face down.

4. Does breathing hot or cold air change your lung volume? Measure your lung volume outside on a very cold day, and compare it to your lung volume measured in the classroom.



Open-House Night. Show your visiting parents how to measure their lung volumes and heights. How do their heights and lung volumes compare to yours?



DISINFECTING THE EQUIPMENT

Technique Card

Certain HAP activities feature materials that need disinfecting before they are reused by other students. In some activities there is enough equipment so that the materials may be soaked in the dilute bleach disinfectant

after the activity. In other situations, shared materials must be *wiped* with the disinfectant before the next student uses the materials. Each folio informs you as to which kind of disinfectant station, if any, you will need.

WIPING STATION

Materials:

1 pint of household bleach
1 bucket
paper towels*
water*

*Provided by the teacher.

What to do:

1. Make the dilute bleach disinfectant by adding 2 capfuls (1 tbsp.) of bleach to one gallon (4 liters) of water (preferably warm or hot) in a bucket.
2. Place the bucket and paper towels in an accessible classroom location.
3. During the activity, use a paper towel dipped in the solution to thoroughly wipe the parts of the equipment that contact the mouth, eyes, or skin.



SOAKING STATION

Materials:

1 scrub brush
1 pint of household bleach
1 pint of household detergent
1 bucket
water*
sink* (optional)
paper towels*

*Provided by the teacher.

What to do:

1. After the activity, collect the used equipment in the bucket, and take the bucket, bleach, detergent, and brush to the sink area. (If you don't have a sink, disinfect the equipment in the bucket.)
2. Use the brush to scrub the equipment pieces in a sink or the bucket full of soapy water.
3. Empty the water, and rinse the equipment.
4. Make the dilute bleach disinfectant in the bucket. (Use the same formula described in the "Wiping Station" section.)
5. Soak the equipment in the disinfectant for two to three minutes.
6. Dry the equipment and store it in clean plastic bags.

